MICROFILMED

BY

KEUFFEL & ESSER COMPANY

1521 N. Danville St., Arlington, Va. 22201

REEL NO. 1/1

REDUCTION RATIO 9X

MICROFILMED FOR University of South Carolina

CONTENTS

STARTS	ENDS
"The Diamond" by	D. Draper & M.E. Frames, d & d 1898

481
D79

To Mr C.F. Kerb-
from Davis Draper
Aug 24 1903.

THE DIAMOND,

A Pamphlet describing the most reliable indications and the principal minerals associated with the

DIAMOND IN SOUTH AFRICA,

WITH HINTS TO PROSPECTORS IN SEARCH OF THESE GEMS.

ILLUSTRATED WITH MAP AND SECTIONS.

BY
DAVID DRAPER, F.G.S., AND MINETT E. FRAMES.

PRICE 5s.

JOHANNESBURG:
MATTHEWS & WALKER, PRINTERS
1898.

Mr. DAVID DRAPER,

Fellow of the Geological Society of London.
Member Fed. Inst. Mining Engineers, North of England.
Member Geogr. Soc. of Holland.
Hon. Secretary Geological Society of South Africa.
Curator Chamber of Mines Mineral Collection.

LONDON OFFICE :

No. 448, MANSION HOUSE CHAMBERS,

No. 11, QUEEN VICTORIA ST.

SOUTH AFRICAN ADDRESS :

Box 460, JOHANNESBURG. Office: CHAMBER of MINES,

AND

Mr. M. E. FRAMES,

Who has been for many years connected with Diamond and Gold Mining in the Free State and Transvaal, will inspect and report upon Mineral Properties in any portion of South Africa.

DIAMONDS A SPECIALITY.

Extracts from Local Press Reports:

"Mr. Draper identified the specimens fr m Rietfontein as being diamondiferous, in February, 1897."—*Standard and Diggers' News*, Sept. 21st, 1897.

"The lessees of Rietfontein were invited to look for gold and cinnabar and to their a tonishmen , they were instructed by a leading geologist (Mr. Draper) to forget those minerals, and seek for diamonds."—*Johannesburg Star*, Sept. 21st, 1897.

"Mr. David Draper recognized the specimens brought to him (in February, 1897) as diamondiferous rock. and recommended the owners (of Rietfontein) to search for the precious mineral, whose efforts, thanks to geological science, were gratifyingly successful, and have placed beyond doubt for the first time, the existence of a true diamondiferous pipe in the Transvaal."—*Machinery*, October 1st, 1897.

The owners have acknowledged that Mr. Minett E. Frames found the first diamond at the Rietfontein Mine, in the washing operations.

THE DIAMOND,

A Pamphlet describing the most reliable indications and the principal minerals associated with the

DIAMOND IN SOUTH AFRICA,

WITH HINTS TO PROSPECTORS IN SEARCH OF THESE GEMS.

ILLUSTRATED WITH MAP AND SECTIONS.

BY

DAVID DRAPER, F.G.S., AND MINETT E. FRAMES.

PRICE 5s.

JOHANNESBURG:
MATTHEWS & WALKER, PRINTERS
1898.

Dedication.

To the great army of prospectors whose efforts have done so much towards the development of the mineral resources of South Africa, this little work is respectfully dedicated by the authors, in the hope that each one who purchases a copy will discover a diamond mine and make his pile.

INTRODUCTION.

In placing this pamphlet before the public we do not pose as philanthropists. We have had a fair amount of experience in diamond mining, both on the River and at the Dry Diggings, and are under the impression that those who do not know what a rough diamond is like, or are ignorant of the character of the mineral in which these gems are found, and the indications which have hitherto led to the discovery of the various mines, will gladly avail themselves of the hints contained in this little work. When we were prospecting in the early days of the diamond industry, we would have paid a great deal more than the price asked, for a work containing the same amount of information. We believe that old diamond miners may also pick up a few hints from a perusal of these pages. Very few men have visited all the diamond mines in South Africa as we have done and noted the peculiarities of each one.

Then again, everybody does not know what a diamond is like, nor how to search for it, though old hands will probably air their superior knowledge and tell us that "no man can be mistaken if he has once handled a few diamonds." But this is by no means the case, as the history of the famous Monastery zircon will tell. In this instance experienced diamond men were uncertain, and some even offered large sums of money for a comparatively valueless stone.

We have advised prospectors to proceed on the lines we would go to work ourselves, and to search for indications which we consider the most reliable, and we have therefore every confidence in placing our notes on the diamond, and how to find it, before those in search of these valuable gems, feeling assured that our work will be appreciated.

The first undersigned was connected with the earliest diamond diggings; he worked on the river at Pneil and at Du Toit's Pan, and assisted the Surveyor in measuring the claims on the New Rush (now Kimberley Mine) on the day they were given out, and worked for several years thereon.

Mr. Frames grew up on the Diamond Fields, and was connected for a long time with the development of Jagersfontein Mine, in which his father (Mr. W. Frames) was a large proprietor.

With regard to the last discovery, Rietfontein, Pretoria, we who are *de facto* the discoverers of this mine, and take this opportunity of making the fact public, were led to the identification of the diamond bearing mineral, by the occurrence of the various

minerals which accompany the diamond in every mine in South Africa ; and so once more the " carbon," " garnet," and " green stone " have done good service in the development of the mineral resources of this country.

We were told when we first made this discovery public that " blue ground " had never been found on the surface, and that Kimberley and the other diamond mines were covered with lime, and Rietfontein, Pretoria, was not, consequently it could not possibly be a diamond mine. But we pinned our faith on the diamond's inseparable companions, and they have not failed us. The now recognised importance of Rietfontein is therefore practical proof that we were entitled to give an opinion on the subject.

The fact that diamonds existed in the Transvaal has been public property for a number of years, but hitherto the home of these valuable gems was a mystery which we have succeeded in solving.

That the Rietfontein Mine, Pretoria, should have been prospected for *coal* firstly, and later on for *mercury*, is another proof of the ignorance of a great number of men who pose as authorities upon the indications of the diamond. It will not be believed by old diggers that shafts were actually sunk to 35 feet in " blue ground," without the prospectors discovering the value of the spot they were working, yet such was the case.

The mineral from this shaft has lain exposed for a number of years, and been visited by a great many mining experts, but only one of these, Mr. H. B. Bunkell, appears to have recognised it as " blue ground."

In conclusion, we would advise those who wish to become thoroughly acquainted with the diamond bearing minerals of South Africa, to visit the mineral collection of the Chamber of Mines of the South African Republic, where the finest and most complete collection of specimens from the various mines is on view.

David Draper.
Minett E. Frames.

CONTENTS.

	Page.
Introduction.	
COLOURED PLATE No. 1.	
CHAPTER I.	9
WHAT IS A DIAMOND.—Colour and Composition, Form, Hardness, Lustre. Summary of its principal characteristics	10
Boart, Carbon or Carbonado	11
How to identify a Diamond	12
Minerals which may be mistaken for a Diamond ...	13
CHAPTER II.	14
MINERALS WHICH ARE FOUND IN COMPANY WITH THE DIAMOND IN SOUTH AFRICA	14
The Garnet, Carbon	14
Olivine, Mica, Vaalite, &c.	15
CHAPTER III.	16
THE DIAMOND DEPOSITS AND ROCKS	16
Section 1—The River Gravels	16
Section 2—The volcanic pipes or chimneys known as the dry diggings	17
Yellow ground and Blue ground...	18
Hard Bank	19
CHAPTER IV.	20
GEOLOGICAL POSITION OF THE VARIOUS DIAMOND MINES Rietfontein, Kimberley and De Beers Plate. ...	20
Jagersfontein, Kaalvalley (Robinson's), Driekoppies, Monastery, Carmel	21
CHAPTER V.	22
BRIEF DESCRIPTION OF THE DIFFERENT DIAMOND MINES IN THE ORDER OF THEIR DISCOVERY.—	
Bultfontein	22
Du Toit's Pan ; Jagersfontein	23
Old De Beers—Kimberley	25
Koffyfontein—The Monastery	26
The Robinson-Rietfontein (Pretoria)	28
CHAPTER VI.	30
HOW TO PROSPECT FOR DIAMONDS AND THE PLANT REQUIRED, by M. E. FRAMES	30
CHAPTER VII.	35
WHERE TO SEARCH FOR DIAMONDS	35
Conclusion	37
A FEW HINTS TO PROSPECTORS	37
Appendix	38
First Law for the regulation of Diamond Mining in South Africa. Weights used for precious stones	43
Hardness and specific gravity tables	40

PLATE I



Fig. 1.

Piece of Hard Blue Ground, with Diamond and Characteristic Minerals in Natural Colours.

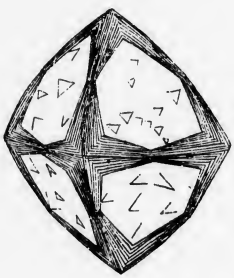


Fig. 2.

South African Diamond Octohedron, copied from "Dana's Mineralogy."

THE DIAMOND.

Chapter I.

WHAT IS A DIAMOND?

There are three varieties of the Diamond—

The Gem or Precious Stone.
Boart.
Carbon or Carbonado.

THE GEM OR PRECIOUS DIAMOND.

Colour and Composition.—The diamond is a precious stone, generally white or colourless, though found of various tints ranging between white and black, but of which pale yellow or straw colour is the most frequent (after white and colourless).

Red, orange, and blue diamonds are rare, but smoky or light brown are frequently found; blue is most uncommon.

The colourless stones are almost invisible in clear water. If a diamond is colourless and free from flaws and spots, it is called a "first water stone" and is of the highest value in proportion to its weight and shape.

The diamond is composed of pure carbon and can be completely burned to carbon dioxide (carbonic acid gas) between the poles of a battery, leaving no ashy residue behind.

It is infusible, but when exposed to great heat in an atmosphere free from oxygen, it swells up into a black mass like graphite or coke. It is also unaffected by acids.

Its specific gravity is 3.5 ($3\frac{1}{2}$ times heavier than water).

Form.—Diamonds are found in a crystalline form; octohedrons or eight-sided stones are the most numerous. A perfect octohedron has eight flat sides or "facets," each of which should be a perfect equilateral triangle. Generally these facets are somewhat distorted in shape, and the angles and sides are slightly curved.

Some diamonds have their facets marked with small triangular indentations as shown in figure 1, plate 1, which represents the form and mode of crystalization of a perfect octohedron. The drawing is copied from Dana's Mineralogy.

Other forms of crystalization occur, but they are all modifications of the octohedron. Diamonds are never found of the same shape as quartz crystals, which have six sides and six triangles converging to a point, either at one or both ends.

HARDNESS.—Though several of the harder minerals will *scratch* glass, only the diamond will *cut* it. Glaziers diamonds are those having an acute angle, selected on this account because they cut glass more effectively than ordinary diamonds would do.

In the scale of hardness the diamond ranks highest, corundum being the nearest to it, topaz and quartz following in succession. Consequently a diamond will scratch all other substances, *but cannot be scratched by any other mineral except a diamond.*

It is possible to cleave a diamond along certain planes (with the grain), and it can be crushed by a blow with facility.

Many good gems were lost in the early days of diamond mining is South Africa by what was called the "anvil test," which consisted of placing the diamond upon an anvil and striking it a smart blow with a hammer. Naturally, but a small cone of dust remained behind. If a stone stood this test it was supposed to be a diamond, but there is no instance recorded of any one surviving such rough treatment.

LUSTRE.—Even in its rough or uncut state, a pure diamond is generally so lustrous that it can easily be distinguished from among a cluster of clear quartz or other glittering stones. It has a lustre peculiar to itself, which once seen is not readily forgotten.

Occasionally diamonds are found which have a dull coating or covering. These are often of a good shape, but close examination is necessary to detect the lustre beneath the skin.

In addition to the peculiarities above mentioned, a diamond has a soft soapy feel, which is so noticeable that experienced men can distinguish these gems from any other by the sense of touch alone. Even the fragments of a diamond show this feature in a marked degree.

Quartz crystals are rough along the edge and even the topaz, which is often mistaken by the inexperienced for a diamond, is rough compared to the latter gem.

Diamonds are frequently found in fragments (chips and cleavage) of all shapes, sizes and colours, but with the exception of shape the above description is applicable to these equally as well as to perfect stones.

SUMMARY OF THE PRINCIPAL CHARACTERISTICS OF THE DIAMOND.

COLOUR.—From white or colourless passing through yellow, red, orange, green, blue, or brown to black. The three first-

mentioned colours are common, the others rare. It is also transparent and translucent.

FORM.—Octohedron (eight-sided), dodecahedral (twelve-sided), most frequent, but mackle or flat twin crystals are sometimes found, and in all mines a proportion of the diamonds are found in a fragmentary form, known as chips and cleavage.

HARDNESS.—Exceeding that of all other known substances. The nearest to the diamond in hardness is corundum or emery, the topaz and quartz following in succession. Consequently the diamond will scratch all other minerals, but cannot be scratched by any of them. *See Hardness Table.*

LUSTRE.—Most noticeable in clear stones of any colour, but occasionally obscured by a thin skin or covering.

NOTE.—A piece of clear alum, filed to the shape of a diamond, and then sucked for a few moments, is a very good imitation, in colour and lustre, of a good white stone.

GRAVITY.—Exceeding that of most other gems, but less than that of the sapphire, topaz, zircon and garnet. *See Gravity Table.*

ELECTRICAL PROPERTIES.—Negative, but becomes electrical by friction and will retain this property for about thirty minutes.

FEEL.—Soapy to the touch. This is most marked, and is a characteristic belonging solely to the diamond amongst gems.

BOART.

Boart is generally of a greyish or lead colour, has a rounded form, and often a number of small fragments are aggregated together, forming clusters, or enclosing crystals. Its hardness exceeds that of the diamond itself, slightly, but its specific gravity is less ; 3.15. It has a greasy lustre, and is smooth to the touch like a diamond. Boart is occasionally found in lumps of considerable size. Kimberley Mine produced a piece over 600 carats in weight.

Crystals or fragments of crystals useless as gems are also called boart in the diamond trade. (Dana.)

CARBON OR CARBONADO (BLACK DIAMOND).

This mineral has not yet been identified in the South African Diamond Mines. What is called carbon here is in reality either ilmenite (titantic iron) or magnetite (magnetic iron).

Brazilian carbon is massive with crystalline structure, sometimes granular to compact, without cleavage. Hardness is greater than with the crystals (of diamond) and it is less brittle, its

specific gravity is less, due in part to slight porosity. Lustre resinous to adamantine, colour black or greyish black. It is opaque.

Found occasionally in large masses up to 731 carats. (Dana.)

There are gradual transitions from the perfectly crystallized diamond through various forms imperfectly crystallized or made up of several individuals to the true boart, and again between the boart and carbonado.

HOW TO IDENTIFY A DIAMOND.

The first test to be applied to any stone which may be considered a diamond is to try its hardness. For this purpose a glazier's diamond is of great service. If the stone can only be scratched by exerting considerable pressure, the probability is that it is the gem sought for, but in order to decide this point definitely, it will be as well to apply a few more tests. The gravity may be approximately ascertained by dropping the specimen into a small phial containing about 1oz. of "Gravity" solution This most valuable solution, useful for determining the comparative gravity of a great number of minerals, can be obtained from Messrs. Taylor & Co., chemists, Von Brandis Square, of any required density, prepared in ounce bottles. It is a strong poison and must be used with great caution. The method of determining the comparative gravity is to drop the mineral into the solution ; if of greater specific gravity than the liquid it will sink to the bottom, if of less it will float. For testing the gravity of diamonds the solution should have a sp.g. of not less than 3.1. If the specimen floats on the surface of the liquid it may be discarded as worthless If it sinks to the bottom rapidly it is either a diamond, sapphire, topaz, or a zircon, but if in addition to its sinking in the fluid it will stand the hardness test, no further examination will be necessary—it will prove to be a diamond right enough.

Both the topaz and zircon are soft compared to the diamond. The former is 8 in the scale of hardness, the zircon 7.5, the diamond 10.

Another test is its electrical properties. A diamond becomes strongly electrical when rubbed, and will then attract light objects. such as a small piece of paper. Other uncut gems do not exhibit this property.

The sense of touch plays a considerable part in the identification of a diamond, but experience is necessary before this can be relied upon. No other mineral crystal feels so smooth and soapy to the touch as the diamond, even if in a rough state or in its most fragmentary form, as well as when in the shape of a most perfect crystal

No guide can be given with regard to colour, though the greater number of diamonds are white, colourless, or yellow.

MINERALS WHICH MAY BE MISTAKEN FOR THE DIAMOND.

QUARTZ.—This mineral crystallises in a different form from the diamond. When perfect, a quartz crystal has six sides, and each end has six triangles (generally varying in size) which converge into a point. It is much softer and lighter in gravity. It can be scratched easily with a glaziers diamond, and will float on the surface of the "Gravity solution" of a gravity of 3.1. *See Gravity Table.*

It has not the lustre of the diamond, though exceptional crystals of quartz are lustrous to a considerable extent.

TOPAZ.—Is equal to the diamond in gravity, but can be scratched with ease by a glazier's diamond, and though colourless is generally deficient in lustre and is flat in shape.

THE ZIRCON.—Is much heavier than the diamond, is lustrous to a marked degree, but is rarely white, generally light yellow, and can be easily scratched with a diamond.

NOTE.—A stone found in the Monastery Mine was so like a diamond in shape and lustre, that it puzzled a number of experienced men. On the tests of hardness and gravity it failed utterly, and was found to be a zircon.

Chapter II.

THE MINERALS WHICH ARE FOUND IN COMPANY WITH THE DIAMONDS OF SOUTH AFRICA.

Diamonds are mined in two different classes of rock :—

1st. The alluvial gravels found along the banks of the Vaal River and some of its tributaries.

2nd. The volcanic pipes containing the mineral known as "Kimberlite."

These are so distinct from each other that, they will be dealt with separately later on, this chapter being devoted to a brief description of the chief minerals which accompany the diamond, both in the river gravels and volcanic pipes.

THE GARNET.

Foremost amongst these is the beautifully coloured garnet without which the diamond has not yet been discovered here.

Composed of allumina and silica, tinted by per-oxide of iron, these stones, which on account of their beauty, may almost be classed as gems, are of a deep red colour generally, though there are varieties such as Essonite, called cinnamon stone on account of its resembling that spice in colour; Grossularite which is green, and several others of different colours.

Those found in company with the diamond are generally of a deep red colour, and belong principally to the variety called "Pyrope," and are frequently much rounded as though they had been subjected to a considerable amount of friction. This is a peculiarity of this variety of garnet. It is found in the Tyrol of the same form, and also accompanying serpentine rocks, as in the diamond pipes of South Africa. Garnets are abundant in the volcanic pipes, but less so in the alluvial deposits.

Carbon.—This name was given to the small black fragments of ilmenite which are found accompanying the diamond. It is a black mineral, glossy where fractured, occurring sometimes in distinct cystalline form, though generally fragmentary. It has a chroncoidal (shell-like) fracture, and a specific gravity surpassing that of the diamond (4.5).

Occasionally, as in the Monastery Mine, "carbon" is found in pieces of over one pound in weight.

The mineral called "carbon" here must not be confounded with the true "carbon" or "carbonado" which is found in the Brizilian Mines.

The latter is of sufficient hardness to be employed in rock drilling, whereas the former is a soft and brittle mineral, for which no use has yet been discovered.

Olivine (green stone of the miners) An emerald green stone generally found in small fragments only, but invariably accompanying the diamond in the volcanic pipes. It can be scratched with a knife, is brittle, and has a sp. gravity about equal to that of the diamond (3.5).

Mica.—A variety of *Mica* called " vaalite " in mineralogy. This mineral was identified in the diamond pipes of South Africa by Messrs. Maskelyne and Flight, before whose discovery it was unknown ; the name " vaalite " is after the Vaal River.

It differs from other micas in several important respects which were considered sufficient to entitle it to a distinct name.

It is of a brownish colour, not yellow or black like" phlogopite " or " biotite," and it also differs from the variety known as " muscovite," from which the large sheets are obtained. It is generally intersected by a large number of fine lines running parallel with each other, and occurs in small plates only ; these, however, show a distinct lamination similar to that of the other micas.

Magnetite or magnetic iron is also found in the diamond deposits of both classes. It cannot readily be distinguished from the mineral called " carbon " though it is duller in lustre and often cubical in form.

In the alluvial gravels many " agates," " carnelians," " cats eyes," and stem-like " zeolites " are found in addition to the minerals already mentioned. Most of these appear to have been derived either from the decomposition of the diabase amygdaloids, through which the Vaal River travels for a great number of miles, or from the destruction of the pipe amygdaloids of the Drakensberg, which would free the stem-like zeolites.

The matrix which contains the diamond and associated minerals in the volcanic pipes, is a variety of serpentine derived from the decomposition of a rock rich in olivine and known in mineralogy as " Kimberlite."

Chapter III.

THE DIAMOND BEARING DEPOSITS AND ROCKS.

SECTION I.

THE RIVER GRAVELS.

Diamonds were first found associated with certain isolated patches of gravel along the banks of the Vaal and Orange Rivers.

The principal of these were situated below the town of Christiana on the Vaal, and near Hopetown on the Orange River though occasionally diamonds have been picked up as high up the former river as Boshoff. Many patches of diamond bearing gravel were found near Klipdrift (now Barkly), and on the Pneil Mission Grounds on the Free State side of the Vaal River.

There are also isolated patches of gravel in which diamonds have been found on the Modder River below its junction with the Reit, and also in the bed of a small creek which enters the Sand River, near Rhenoster Kop, in the Kronstad district of the Orange Free State.

River gravels produce diamonds of great purity and good size, but the yield is comparatively low and the finds most erratic.

Few fortunes have been made at the River Diggings, and there are not many miners at work on the river at present.

There does not appear to be any true indication of the presence of the diamond in the river gravels. Carbon and garnets occur, but in lesser quantity than in the " dry diggings."

River miners will explain the peculiarities of the diamond bearing gravels as distinguished from the barren deposits, but these indications are more imaginary than real, and are of little value to the prospector.

As the river diamonds were probably derived from the destruction of a diamondiferous pipe, situated somewhere in the river channel, it is natural to assume that the diamonds will be most unevenly distributed and be associated with any alluvial deposit which has lodged along the banks of the stream.

The stones generally accompanying the diamond in th alluvial gravels are described in chap. ii., page 14.

SECTION II.

THE VOLCANIC PIPES OR CHIMNEYS, KNOWN AS THE DRY DIGGINGS.

The bulk of the diamonds found in South Africa are derived from the volcanic pipes or chimneys which are found scattered about the country.

These occur in different geological formations and are not confined to any particular stratum or period.

They are generally irregularly circular in shape, of limited extent and surrounded by barren country rock. They are true volcanic pipes and chimneys, which have served as the vents for the passage of molten or muddy material from subterranean reservoirs.

The theories of the formation of diamonds form a most interesting subject, but one which cannot be dealt with in so small a volume as this, nor are they of any practical interest to the prospector.

What he has to deal with is the economic side of the question. For his purpose the following description of the mineral will be of more service. It is, however, somewhat difficult to describe the peculiarities of the diamond bearing mineral in such language as will be easily understood by those not accustomed to minerological terms.

Firstly it must be understood that the different diamond mines, though situated many miles apart, all contain the same class of mineral which is known as " Kimberlite " by mineralogists.

In all the known mines there is a distinct difference between what is known as " yellow ground " and the " blue." The former is situated near the surface, and is in reality the decomposed or much weathered portion of the " blue," which again is the partially weathered form of the extremely hard mineral —of the same composition as the " blue,' but much harder—known by diggers as " hard bank."

" Hard bank " is no doubt the original and true diamond bearing rock. All these varieties occur in the different mines in greater or less proportion. In the Kimberley Mine the blue was struck at about 100 feet, and the diggers thought they had reached bed rock when they found so great an alteration in the mineral they were operating on. In other mines the depth varied with the amount of decomposition to which the mineral had been subjected.

In the most recent discovery, " Rietfontein," the yellow ground is limited to a few feet in thickness.

In their order of occurrence these different stages of the diamond bearing mineral will be described.

YELLOW GROUND.

As its name denotes this mineral is of a light yellow colour, easily crushed to pieces in the hand (incoherent), made up principally of decomposed olivine and other serpentinuous matter, and it invariably contains garnets, carbon, a peculiar brown mica (Vaalite) in small flakes, an emerald green mineral known by the diggers as olivine or "green stone." All these minerals may be in small fragments scarcely discernable to the naked eye, or in large lumps the size of walnuts or larger, as in the Monastery Mine.

If a piece of yellow ground is crushed between the finger and thumb and rubbed for a few seconds a peculiar greasy feel is noticeable.

Though several minerals give the same results, they are generally laminated, like mica shales, or leafy like talc, whereas the "yellow" is earthy and massive and does not show any lines of stratification or bedding.

If the prospector finds a deposit of mineral which is not stratified but massive, is of a light yellow colour, has a greasy feel when crushed in the hand, contains garnets, carbon, olivine, and thin small scales of brown-coloured mica, he may proceed to search for diamonds with a good prospect of finding them. Naturally it is by no means absolutely necessary that all of these minerals must be present, but there does not appear to be one mine in the country in which they are not found accompanying the diamond, and consequently, as they are in all cases, far more abundant than the diamond itself, they will be more readily found, and therefore can be taken as a fair guide to the position of a diamond pipe. By the aid of these indicators the Rietfontein pipe and several other diamond mines were discovered.

BLUE GROUND.

This is in reality the same mineral as the "yellow ground," but it has been less affected by the action of the weather, percolating waters, and other agents of decomposition. It contains the same minerals, though in the blue the different fragments of mineral matter can be more plainly distinguished by the naked eye. It is, as its name denotes, of a bluish colour when fresh, but changes to grey upon exposure, and it also crumbles to pieces under the influence of the sun and rain, or when exposed to the atmosphere for a length of time, varying with the stage of decomposition it is in. It contains all the minerals which are found in the yellow ground, garnets, carbon, olivine, mica, and it has the same greasy feel when rubbed in the palm of the hand.

It is rarely exposed on the surface of the ground, but occurs at a depth which varies in every mine. The Rietfontein Mine is the only one in which the blue was found actually outcropping on the surface.

HARD BANK, OR "HARDI-BANK."

See plate 1, fig. 2.

This is the parent rock in which diamonds are contained. Blue and yellow ground are hard bank in different degrees of decomposition. It contains the same minerals in a fresher or less decomposed condition than they are in the yellow or blue ground. There is also a peculiar zoning of all the minerals in the "hard bank" which is noticeable to a lesser extent in the blue, but is absent in the yellow ground. That is to say, each different fragment of mineral matter of any size is generally surrounded by a ring or zone of a different colour composed of the altered mineral itself. A fragment of olivine is surrounded by a zone of serpentine (altered olivine). A fragment of diabase is surrounded by decomposed diabase, and so on: so that the mineral appears as if it were composed of a number of rounded or subangular fragments each with a ring surrounding it.

The greasy feel is absent in hard bank, because the mineral is not sufficiently decomposed.

Every diamond bearing pipe contains numerous fragments, and in some instances large boulders of foreign material, hardened shales, sandstones, igneous rocks, and occasionally granite. Many of these have evidently been carried up during the ascension of the original mass, but some, such as the shales, appear to have tumbled into the pipes—from the strata surrounding them—while still their contents were in a semi-liquid state.

All these foreign masses have undergone a certain amount of alteration, especially round their edges.

The Kimberley Mine had a large mass, composed principally of shale, similar to that surrounding the mine, situated near its centre, and continuing downward until the blue ground was reached, when it disappeared. (See section of Kimberley Mine). Very few diamonds were found in the blue ground with which these masses of shale were mixed up.

Chapter IV.

GEOLOGICAL POSITION OF THE VARIOUS DIAMOND MINES.

The gravels in which diamonds are found along the Vaal River belong to deposits which are slightly older than the gravels of the present river bed, and they probably represent the position which the stream occupied in past times. before it had excavated its present channel.

No animal remains or other evidences have been found by which their age could be identified with any degree of certainty.

The pipes or chimneys in which diamonds occur lie in strata of different geological ages. The last discovered—the

RIETFONTEIN MINE

—is situated in an older series of rocks than any of the other mines.

Outcropping in a stratum of the Magaliesberg quartzites, by which rock it is almost surrounded, it is associated with what is generally supposed to be carboniferous rocks, though they do not contain any coal beds, but insignificant layers of graphite. These do not, however, come to daylight in the vicinity of the mine, and their nearest outcrop is apparently the Wonderboom Poort, near Pretoria.

The Rietfontein diamond pipe is especially interesting as being the first diamond mine found in the Transvaal, the furthest in distance from the Kimberley group, and to its being situated in an older geological period than any of the other mines.

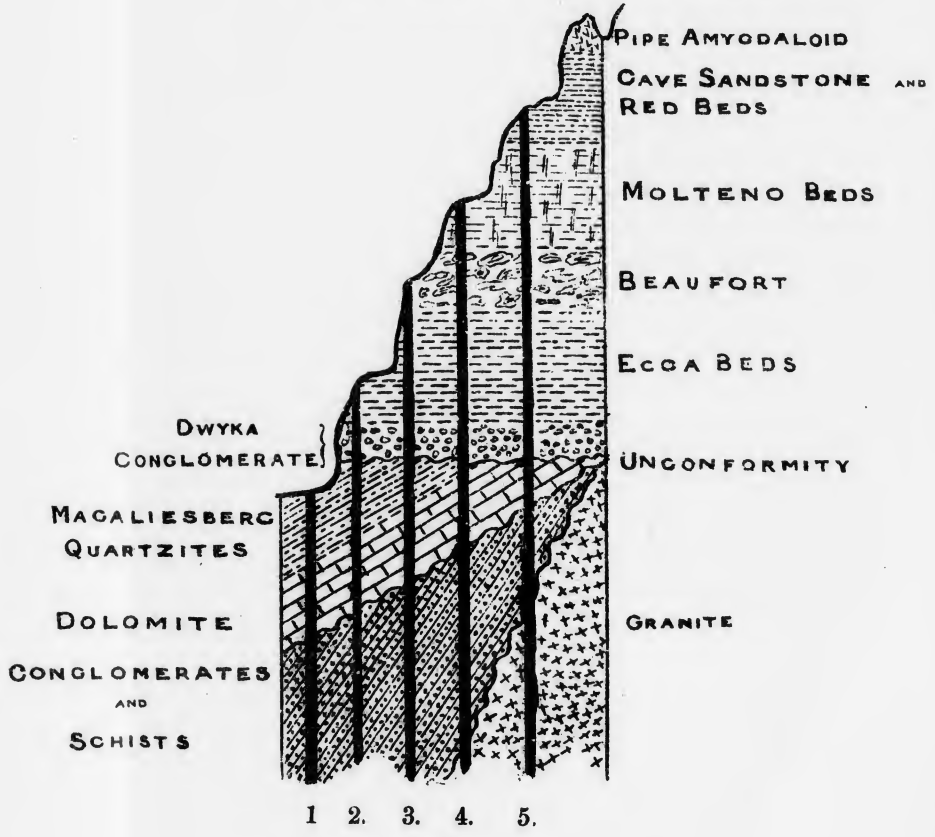
In geological position the group of diamond pipes of which

KIMBERLEY AND DE BEERS

are the best known, are the next in upward succession. They are situated in the lower portion of the Ecca or Lower Karoo beds, which series is, however, of no great thickness there, dwyka conglomerate and quartzite occurring, the former at a depth of about 600 feet and the latter at some distance lower down. Several of the pipes in the Kimberley group were covered with limestone tufa. This was especially the case with regard to Kimberley Mine itself, and Wesselton, near Du Toit's Pan.

When, however, the fact is taken into consideration that the western portion of the Orange Free State and Griqualand West, is to a large extent similarly covered, this occurrence of lime on the surface, and overlying the diamond mines, is of no consequence so far as the mine itself is concerned, though it adds to the difficulty of prospecting and hides the diamond pipe from view.

GEOLOGICAL POSITION OF THE DIFFERENT DIAMOND MINES



1 RIETFONTEIN.

2. KIMBERLEY.

3. JAGERSFONTEIN.

4. ROBINSON.

5. MONASTERY.

Special mention is here made of this lime deposit because there appears to be a general opinion that a diamond mine must necessarily have such a covering, and the Rietfontein discovery was regarded with scepticism because the lime was wanting thereon.

JAGERSFONTEIN.

Beaufort beds are the prevailing rocks near Jagersfontein, which is consequently associated with a younger period than Kimberley.

In the next series in upward succession there is the Kaal Valley group (Robinsons) and the Driekoppies Mine in the Kronstad district.

Coal beds outcrop in the neighbourhood of both these mines, and fossil evidence as well as characteristics of the rocks point to the Molteno or coal bearing strata as the system with which they are associated.

Finally, the MONASTERY and its neighbour the CARMEL MINE are both in the lower or red bed portion of the Cave Sandstone period, and consequently appear in the youngest sedimentary beds on the plateau of the Orange Free State. The Monastery is higher than any of the other mines. It is 5,700 feet above the sea, Rietfontein being 5,000 feet, Robinsons about 4,615, Jagersfontein 4,750, and Kimberley about 4,012.

It will be seen from the foregoing that diamond mines occur in Southern Africa in all geological periods ranging between the Devonian and the Cave Sandstone or Jurassic. That they are confined to no particular stratum or series, nor are they associated with any one sedimentary bed, geological horizon or altitude. They occur scattered about the country with nothing definite to guide the searcher as to their position, except certain peculiar mineral features or minute fragments of the minerals found in company with the diamond.

When the earlier discoveries of diamond pipes were made there was a tendency on the part of the miners to limit the possible area over which diamond mines would be found to a small circle round Kimberley. The discovery of the Monastery Mine has placed beyond the region of doubt the fact that a diamond mine may occur in any one of the strata which is found lower than the pipe amygdaloid of the Drakensberg, and this increases the prospecting area to a practically unlimited extent.

Rumours of diamond mines being found in the Waterberg and Zoutpansberg, have undoubtedly a foundation of fact to support the many stories which are brought down from those parts by prospectors, and there is every probability that these gems will be discovered there in the near future.

Chapter V.

BRIEF DESCRIPTION OF THE DIFFERENT DIAMOND MINES IN THE ORDER OF THEIR DISCOVERY.

BULTFONTEIN MINE.

The existence of diamonds in the area lying between the Vaal and Modder Rivers was discovered through the farmers being induced to collect stones and submit them to the inspection of Mr. Hond, who was under the impression that the diamonds in the Vaal River gravels were derived from some centre which would prove to be a mine. Amongst the collections was a couple of bottles full of pebbles which had been picked up near the homestead on the Farm Bultfontein. These were submitted to Mr. E. E. Hurley, Jacobsdaal, and Mr. Hond discovered therein one small diamond. A week later Mr. Lilienfeld, together with Messrs. Hurley, Hond and Webb, purchased the farm, and the public were allowed to search for diamonds on the surface, where fragmentary and imperfect stones were discovered in great quantities.

The Bultfontein Mine, from the surface downwards, is similar in many respects to the other leading mines of the Kimberley group, in having a few patches of lime tufa underlying the red surface soil. The yellow ground continued downwards for about 100 feet in portions of the mine. The notable characteristics of the Bultfontein Diamond Mine lies in the preponderance of garnet and greenstone rather than of carbon ; the latter is plentiful, however, as is also topaz (Dutch Boart), agate, carbon, and numerous crystals, are found. The yield ranges from 7 carats to 40 carats per 100 loads. In general appearance a large number of the stones found at Bultfontein are octohedron in shape, and frosted in appearance. To a novice a parcel of Bultfontein diamonds would appear of very superior quality owing to their whiteness. Closer examination shows that the majority of these white stones are spotted, and their value much lessened in consequence. Owing mainly to this detrimental feature Bultfontein diamonds usually fetch a lower price all round than those from other mines of the Kimberley group. Large diamonds are also rare at Bultfontein, seldom occurring over 50 carats in weight, and then generally of a straw colour. As in all diamond mines the ground is very patchy, certain portions of the mine are rich in diamonds, whilst others in close proximity are poor.

In the extreme north-east corner of the mine the yellow ground was extremely poor, and the quality of the diamonds bad,

whereas a hundred yards to the south or south-west, the yield was from 30 to 40 carats per 100 loads and the diamonds of good quality. This serves to demonstrate the important fact that no particular spot can be accepted as a true indication of the average value of a diamond mine, and suggest to the prospector the advisability of sinking holes or shafts in all quarters of the mine before giving up all hope of success. Patchiness is a characteristic of all the diamond mines of South Africa.

DU TOIT'S PAN.

This mine lies immediately eastward of Bultfontein, and it is probable that the separation of these two mines are more imaginary than real, and that they are connected underground. The diamonds found in this mine are generally good in shape, free from flaws, but of a bad colour. The deposit differs but little from that of Bultfontein, and the blue ground was reached at about the same distance down. The extent of this mine exceeds that of any other diamondiferous pipe, and it is questionable whether its limits are rearly known even yet. It is very irregular in shape.

JAGERSFONTEIN.

The discovery of the Jagersfontein Mine was prior to that of Kimberley, but as the owner thought himself quite equal to working the mine, no one was allowed to acquire claims Soon, however, he recognised the advantages of allowing others to assist him, and to peg out claims.

The mine is situated amidst dolerite hills with an open flat piece of country to the south. The drainage water from these hills, flowed in a channel cut through the western portion of the mine, and it was in this that diamonds were first found. The mine was covered on the western side by a thick deposit of black alluvial soil, whilst the eastern portion lay on the slope of a hill and in parts had a slight covering of lime tufa. On opening the mine it was found that the greater part of it was buried beneath what is known as "floating shale," in which but few diamonds were found, and these only in small pockets of yellow ground contained in the shale. The shale dipped towards the eastern side of the mine, but was not one solid mass, containing in places several claims of a deep yellow looking ground, in which diamonds were found. The mine was more open and quite free of float shale to the west and south, and it was this portion which was worked with varying success.

A peculiar feature in the Jagersfontein Mine was the varying nature of the diamondiferous material, in some parts the yellow ground was extremely sandy with hard nodules

of the mineral cemented together by lime. In other parts a golden yellow ground occurred, which was so soft that without exerting much force a pick could be driven in to it up to the eye. Besides the two kinds mentioned there were several others, and as their nature varied, so did the yield in diamonds. It was no unusual thing in the yellow ground, for a digger to find 8 or 10 carats in 400 loads one day, and on the next from the same amount of stuff to recover from 50 to 80 carats. The erratic yield of diamonds in the yellow ground was the cause of many failures in the early development of this mine from 1867 to 1884. Fresh capital was put into the mine and the blue ground worked. It was found that the yield from this was much more regular than from the yellow, and at the present day the rate is from 11 to 13 carats per 100 loads, valued at from 37s. 6d. to 40s. per carat The diamonds from this mine are superior to those of any other mine in South Africa, a perfect gem is quite equal to a first-class Brazilian stone. Besides these first-water stones, fancy coloured ones are found, chief amongst which are brilliant chocolate coloured gems. The associated minerals are often large, and what are known as ' burnt " garnets of a very large size are frequent, whilst some of the largest diamonds from South Africa were obtained from this mine. It would almost appear as if one could anticipate finding large diamonds when the associated minerals are of abnormal size.

The blue ground is easily pulverised, though like all other mines, " hardbank " is encountered which will not decompose under any condition. The diamond pipe is enclosed by columnar dolerite in a more or less decomposed state, but it stands well, so that the digging operations are not often retarded by falls of so-called " reef " into the mine. The associated minerals are similar to those of other mines, but the stone known as " Dutch Boart," which in reality is a topaz, is plentiful.

Close to the Jagersfontein pipe, and north-west of it, a small pipe exists, known as " Rose's Mine," but it seems still doubtful if diamonds occur there in any quantity. One or two efforts were made to work it, but these were disastrous failures.

Six or eight miles to the east of the Jagersfontein a pipe called the " Contatville " was opened in the early eighties, but it proved to be a complete " duffer," and contained no diamonds. It was worked for a short time, and an ineffectual effort was made to create some enthusiasm over its discovery, but it was soon abandoned and is now almost forgotten.

The mineral matter in the " Contatville " pipe is extremely micacious, and its general appearance indictes its poverty in the precious gems.

OLD DE BEER'S

lies about two miles from Bultfontein on the farm Vooruitzicht. It is similar to the other mines in general characteristics, but differs in having an intrusive dyke known as the Snake Rock running through it in a serpentine course.

The mine was originally worked in patches, such as Schwab's Gully and others, and for a time it was almost abandoned. De Beers has yielded a large number of good stones and many of great value.

It is named after the original owner of the farm Vooruitzicht (de Beer) upon which both it and the Kimberley Mine are situated.

The yield per 100 loads is about 80 carats, and the value per carat 27/-.

THE KIMBERLEY MINE.

No mine is better known to the public than this valuable diamond pipe.

It was discovered on the 13th day of July, 1871—a red letter day in the history of the Cape Colony. The diamond mines previously discovered had, at this time, arrived at a critical stage of their existence, owing to the want of system in their development.

When Kimberley Mine was laid out into claims the Commissioner (Captain Finlayson) adopted—by the advice of the more intelligent and far seeing diggers—a system of roadways which ran from north to south through the mine, and which greatly facilitated its development.

Each claimholder allowed 7 feet 6 inches of his ground to remain unworked, and by this means roadways 15 feet wide intersected the mining area and enabled the diggers to remove the spoil from their claims to the sorting places. Gradually as the workings deepened these roadways were removed, and then the mineral was elevated to the sides of the great pit by means of windlasses, and later on by engine-power. Mounds and hillocks formed from the discarded material and sorted ground, grew in size and magnitude around the mine until the level landscape was transformed into one in which the white tents of the diggers were relieved by a number of grey coloured gravel hills.

The surface of the ground which hid the Kimberley Mine from view presented no indication of the great wealth beneath. A slight rise on the sandy plain, a few kameel thorn trees, and some patches of limestone, were all that struck the eye in glancing over the great expanse of barren territory in which it is situated. A more uninteresting or dreary spot can scarcely be imagined.

The late Mr. Fleetwood Rawstorne, of Colesberg, was the discoverer of this mine. He found a diamond after about a week's work, and the place was rushed by the diggers from the neighbouring mines. In an incredibly short space of time a mining camp with a population of 20,000 souls spread over the plain, and work proceeded with such vigor, as had never been previously witnessed on the Diamond Fields. Diamonds were found in great quantities in some parts of the mine, though other portions were exceedingly poor. In the centre and at the west end diamonds were scarce, so much so, that a huge pillar of valueless ground remained standing in the centre of the mine, until it endangered the lives of the workmen in its vicinity. The richest spots were along the southern and the eastern portion, though the north side had some valuable patches.

The sectional drawing, plate 3, fig. 1, is copied from a larger one found among the papers of the late Mr. G. W. Stow, F.G.S., who sketched it at the time when the miners had reached the blue ground.

It represents the principal features of the mine. The covering of red sand lying upon white tufaceous limestone and succeeded by the yellow, and finally the blue ground and the great central mass of shale are clearly illustrated in this graphic section.

The tilt of the strata surrounding the mine is also shown.

KOFFYFONTEIN

is of great extent and is poor in yield of diamonds, the richest ground producing only 5 carats per 100 loads, while the average from the claims now being worked, is barely 4 carats. This mine affords another illustration of the patchiness of diamond pipes. Fully one-half of it being extremely poor, not yielding more than 2 carats per 100 loads.

There is a great similarity between the mineral of this mine and that contained in the Bultfontein pipe. Garnets and greenstone predominating, while carbon is less plentiful. A striking peculiarity of both these mines is the apparent absence of all affinity between the carbon and garnets, where the former is plentiful the garnet is scarce and *vice versa*, but in no case does the number of diamonds appear to be affected by the abundance or scarcity of either the carbon and garnet.

THE MONASTERY DIAMOND MINE.

This takes its name from the Farm on which it is situated, and which lies at the north base of the Clocolan Mountain, in the District of Winburg and about 36 miles distant from that town.

PLATE 3, FIG. 1.

THE KIMBERLY DIAMOND MINE IN 1871,

AFTER G. W. STOW. F. G. S.

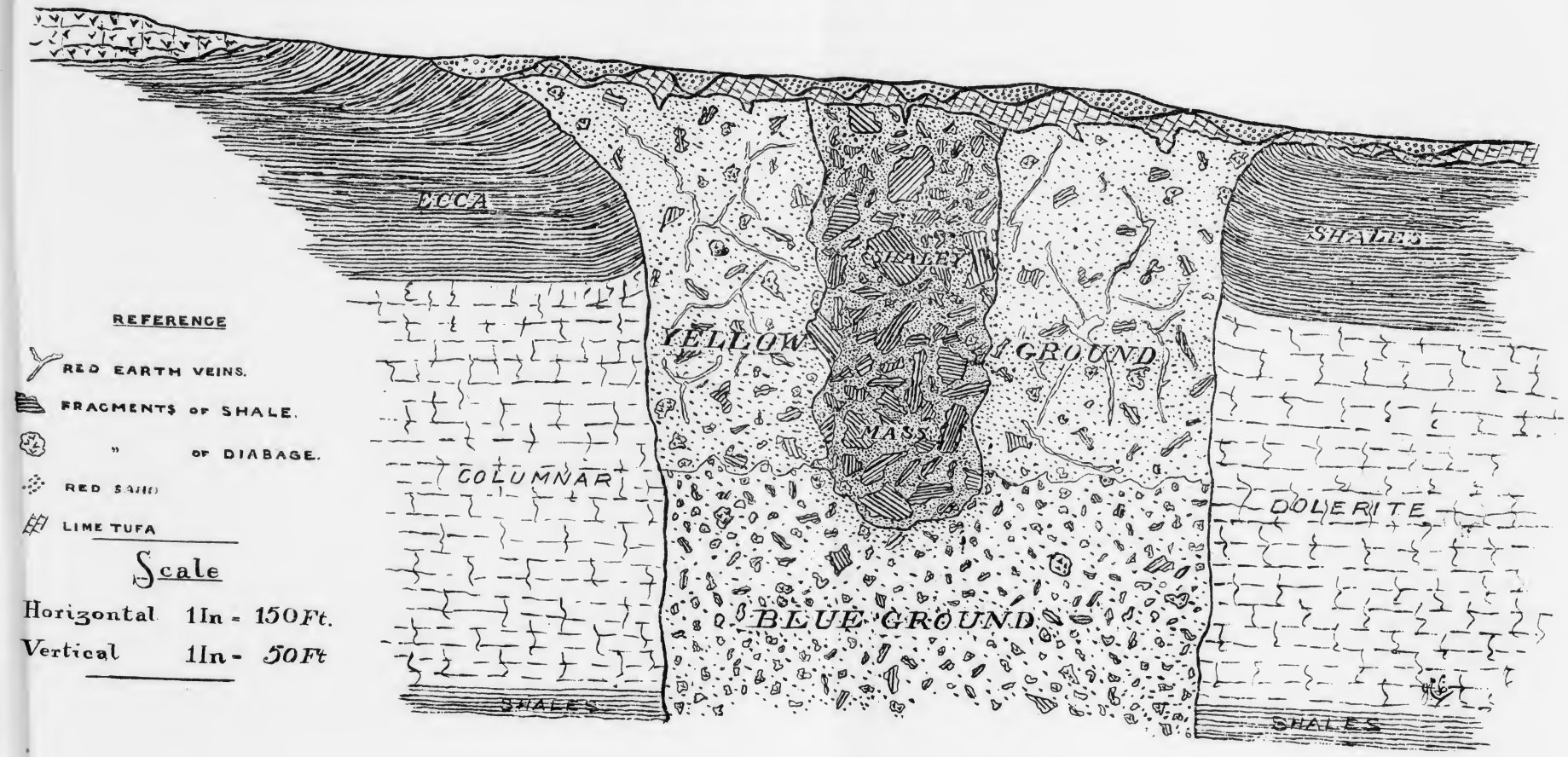
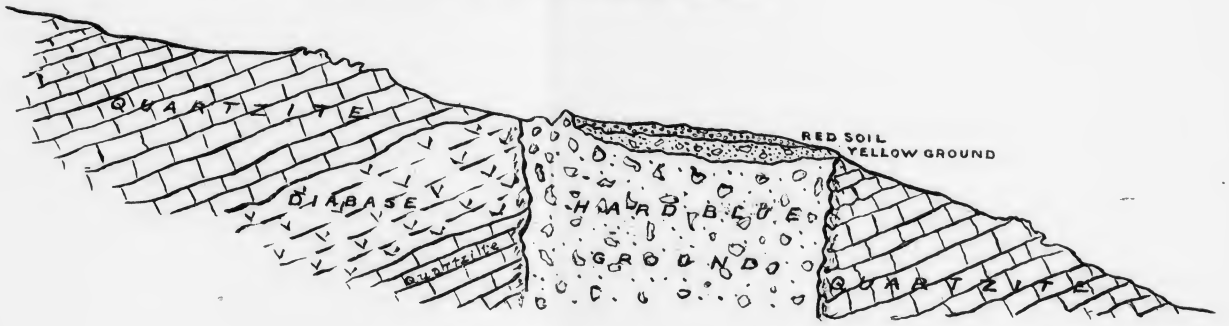


PLATE 3, FIG. 2.

THE RIETFONTEIN (PRETORIA) MINE.



The existence of diamonds were determined about 25 years ago, a farmer, who named the mine "Viljoen's Rush," by which title it is still known to the farmers locally.

This mine has had a most unfortunate career, owing principally to incompetent management and obsolete machinery. The diamonds found there are generally of good quality, and some have realised high prices, but the yield has fluctuated between 6 carats and 20 carats per 100 loads.

The most interesting features about this diamond mine are that it is situated in the highest sedimentary deposit on the great inland plateau, that it is 5,700 feet above sea level, and that there are evidences of its having been worked at some time previous to the discovery of diamonds in South Africa. Human remains and iron implements have been unearthed from a depth of about 25 feet, and the whole surface of the mine appears to have been turned over to an average depth of about 10 feet. Evidence collected from native sources points to the working of this mine by the Basutos to obtain the black glittering fragments of carbon for the decoration of the Basuto ladies, but not to any mining for diamonds. At the present time a certain amount of carbon is sold annually to the Basutos, and they state that for about a century past they have been in the habit of obtaining their supplies of this article of female adornment from this spot.

The "carbons" and "garnets" obtained from the Monastery are phenomenally large, many of the former weighing over one pound, and aggregations of the latter equal to about 6lbs. in weight.

The yellow and blue ground are not distinctly separated as in other mines, and there are large masses of "hard bank" in both the blue and yellow up to within a short distance of the surface.

In this instance again there was no outward sign of the existence of a diamond mine, the small shallow valley which runs parallel with the side of the Clocolan Mountain, was about the last place a prospector would look for a diamond mine: but the old workings visible as small mounds, but slightly elevated above the surface, yielded a few scattered carbons and garnets, and these gave the prospector (Viljoen) sufficient evidence to induce him to sink, with the result that diamond bearing soil was exposed to view.

There is no mine in the country that has greater possibilities than this one. Hitherto the workings have been confined to one small isolated portion of the property, notwithstanding the fact that the diamondiferous ground is known to cover an area which would indicate that this is *the largest pipe yet discovered in South Africa.*

It is possible that the portion which has been operated upon is the most barren in the mine, and that there are rich spots as there are in all other mines.

With vigorous and efficient management the Monastery Mine will some day take a leading part in the diamond output of the Orange Free State. Its yield has varied from 6 to 20 carats per 100 loads. Some of the diamonds found in this mine have been classed with the best Brazilian stones.

THE ROBINSON DIAMOND MINE.

This mine, from which so much was expected, but which has not yet proved to be remunerative, is situated on the Farm Kaal Valley in the District of Ventersburg, and about 12 miles north-west from the Ventersburg Road Station of the Orange Free State line of railway.

The geological period in which this volcanic diamondiferous pipe appears on the surface is at the base of the Molteno beds, and consequently its orifiice is in a younger strata than that of Kimberley and Jagersfontein.

Surrounding the mine there are layers of shale and sandstone tilted on the north side to an angle of about 45 degrees as in the Kimberley mine. The mine is roughly oval in shape, and the longer axis of the oval lies in the direction north-east and south-west.

There was no indication of the existence of a diamond mine on the surface of the ground, which was composed of chocolate-coloured soil. No limestone lay on the surface, neither was there an encircling ring of greenstone such as is generally supposed to indicate the presence of a pipe.

The existence of the diamond was first suspected by the discovery of pieces of carbon, found in the earth that had been brought to the surface by an ant bear, and this was sufficient to encourage the prospectors to sink, with the result that a number of diamonds of good quality were discovered, and the mine was ultimately sold to the Robinson Diamond Mining Company.

The yellow ground in this mine reached a depth of about 40 feet, when blue ground, identical with that of the Kimberley Mine, was struck.

The Robinson mine is not yet in the output stage, the yield per load is unknown, but trial washings gave about 8 carats per 100 loads. The diamonds were of superior quality.

RIETFONTEIN, PRETORIA.

That diamondiferous pipes should exist so far distant from the centres which had been discovered in the early days of

mining was generally disbelieved. The Robinson and Driekoppies Mines proved the extension of the area in which they might be sought for beyond its originally circumscribed limits, but the discovery of the Rietfontein Mine was a revelation to geologists as well as to miners.

The discovery of this mine is another instance of the triumph of science over dogmatism. Blue ground could not possibly exist on the surface was an article of the diamond diggers creed, and therefore even experienced men overlooked the small patch of hard blue ground which cropped up through the Magaliesberg quartzites, and ridiculed the idea that a diamond mine could be found therein. Kimberley and most of the better known mines were in the shales, and there was no shale at Rietfontein.

The white lime was missing on the surface and the surrounding ring was wanting, but the discoverers had recognised the true character of the mineral, and they remained unshaken in their opinion, even when opposed by men of great experience.

Finally, diamonds were found in quantity, and the results are most gratifying to Messrs. Draper and Frames, whose connection with this discovery was published in the local papers in September, 1897, to the owners, and to prospectors in general, to whose investigations a new field has been opened.

Mr. Frames discovered the first diamond in washing the yellow ground, though the owner of the farm (Mr. van der Merwe) had picked up a small stone on the surface near the present mine a few days previously.

Rietfontein Mine differs in many respects, as shown above, from the majority of diamond mines. The mineral in which the diamonds are found is not quite the same in appearance, though it is of similar composition to that of other mines.

There is but a small quantity of yellow ground at Rietfontein, and "hard bank" is the form of the bulk of the mineral.

There is little hope of softer mineral being reached, and greater probability that the density of the hard bank will increase. This will necessitate the employment of crushing machinery similar to that in use at some of the other mines.

Rietfontein is probably the smallest diamondiferous pipe that has yet been discovered, but it also appears to be phenomenally rich, though the bulk of the diamonds found hitherto are not of very good quality, and a large proportion are fragmentary.

Section 2, Plate 3 shows a section across the Rietfontein Mine from south to north at the time of its discovery.

Chapter VI.

HOW TO PROSPECT FOR DIAMONDS AND THE PLANT REQUIRED.—By M. E. Frames.

When the prospector decides upon investigating a certain area, he should be provided with the necessary appliances and implements to conduct his operations in a systematic and workmanlike manner. In addition to the ordinary prospecting gear of picks, shovels, etc., he should have three sieves of different meshes to be used as will be pointed out later on. The one sieve should be coarse enough to allow a stone of the size of a very large pea to pass through, the next in size to allow stones as big as large pins heads to pass, whilst the third one should be so fine as to allow of the free passage of mud and sand only. These three sizes the prospector will find sufficient for all practical purposes. Having procured his outfit the next question is which is the most likely locality to search for diamonds. Naturally the choice falls on those districts where diamond pipes are known to exist, as such localities are more likely to contain other mines which may possibly be hidden from view. As described in chapter VII, the diamond pipes appear to occur traversing the country in more or less straight lines.

Wherever streams run through a farm, or dry dongas and valleys occur, the gravels contained in them should be systematically searched. The *modus operandi* to be followed by the investigator will greatly depend upon the physical feature of the country, and also the distance of water from the ground under investigation and other circumstances. Should a stream occur on the property the gravel along its bed and banks should be first put through the coarse-sized sieve, and can either be sieved direct into the next sized one, or on to a clear piece of ground. After two or three hundred weight of gravel has been sifted, the intermediate sized sieve should be used, and then the finer to shake out the dust and sand. After this has been accomplished the intermediate sieve should be about half filled with gravel or ground, and vigorously shaken with a circular motion inthe water. The matter in which this is done is to sink the sieve beneath the surface of the water, holding it in the hands and spinning it round from left to right, then from right to left, until the gravel contained in it is free of mud. The sieve should be moved backwards and forwards, as if it had an axle passed through its centre and it were being tinsted in a half circle, first to the right then the left. Either water in the stream can be used to pan in, or tubs provided for the purpose. When the gravel is free of mud the sieve should be shaken steadily up and down, and when it is evenly distributed over the

bottom, the up and down motion should gradually cease. On lifting the sieve from the water it should be held in a slanting position to allow the surplus water to run off. An open space free of grass, should then be selected and the sieve turned completely over so as to expose the heavy gravel which has gravitated to the bottom of the sieve. This turning over of the sieve is not easily accomplished and requires practice. The operator should let the sieve lightly rest in the palms of his hands and swing it away from his body, at the same time lifting it into such a position that it can readily be turned bottom upwards, after which it should be brought down smartly on the ground The prospector will find a kneeling position the most convenient to accomplish this feat. Whatever heavy material may exist will have gravitated to the bottom of the sieve by the process described above, and on its complete reversal will be found exposed to view on the surface. Each sieve thus dealt with must be carefully searched and its surface lightly scratched over. Pebbles which present any peculiarities should be taken and carefully inspected, crystals that appear to resemble the diamond should be submitted to the tests already mentioned in the earlier pages of this book. After the intermediate ground has been treated the very fine sieve should be used, and this material should be more carefully dealt with than any of the coarser sizes. The prospector will do well to examine the proceeds of this seiving under a magnifying glass. Any carbons, garnets, or olivine crystals must be taken out and submitted to the magnifying glass so as to be certain of their genuineness. Should the prospector be fortnnate enough to find any of the minerals associated with the diamond in the stream, he should proceed further up along its course and try the gravels, sands, etc., and if these minerals are still encountered, he should continue the operation until they cease to appear. He will now be certain that the mine is not far distant, and must be on one side or the other of the stream, or perhaps in its bed. He must now be careful and ascertain from which side of the stream these indications of the diamond enter, after ascertaining which it is comparatively easy to follow the trail until the mine is met with. Should the stream fail to show any indication of a diamond pipe in its vicinity, the dry courses cut by the rains, should be investigated, and some of the gravels carried to the nearest water and treated as has already been explained. After investigating all the hollows, valleys, streams, and dry dongas or water courses without encountering any encouraging results, the prospector should select certain areas and take these in rotation and examine them almost foot by foot. Some of the sand can be carried to the water and carefully panned in the finest sieve. The associ-

ated minerals must be carefully sought for in these fine sands, as they are easily overlooked.

The prospector need not be anxious to seek diamonds or the associated minerals in the coarse gravel of the first sieve, as he is much more likely to be successful in the finer material. Diamonds of a large size are by no means so very plentiful, neither are large fragments of the associated minerals frequent, and much time is often lost in seeking these. The wash known to diamond miners as " fine sand," should receive the closest attention, and in our experience has resulted in the greatest number of successes. In the event of failure in discovering the indications in the gravels and sands accumulated by the rush of water during the rainy season, the prospector must not be discouraged, as often the pipes are covered by superficial deposits such as sand, lime, etc., which tend to protect the mine from erasion in flat country. It is always well for him to pay careful attention to soil thrown up by such burrowing animals as the ant bear, meercat, etc. These creatures have led to the discovery, in one or two instances, of diamond pipes which placed the fortunate finder in possession of great wealth. Every change in the prevailing colour of the soil should be noted, and the reason for such change carefully investigated. The various colours given to the soil by the decomposition of different rocks cannot here be explained as it might confuse the prospector. and we shall therefore point out the most prominent features which might denote the existence of a mine. Perhaps the prospector on passing over the country notices one patch more or less circular in form, different in colour to the prevailing tint. The reason for this should be looked into and some of the sand panned at the nearest water to ascertain if any indications of the precious gems exist. Should nothing be found he can push his investigations further afield. On the other hand, if he finds the minerals he is in search of, he should at once sink a small shaft testing the gravel and sand every few feet as he sinks down. He may, by this means, encounter the yellow ground, which has been described in a previous chapter Should such be the case, the prospector may now be certain of having hit upon a diamond pipe, and he is fully justified in spending a little capital in judiciously testing its richness in diamonds. This can be done by dry sifting three or four loads of the stuff at the shaft, and then panning it in tubs provided for the purpose. By sifting out the sand by the dry process the water contained in the tubs will not be used up so soon, and grading the stuff to various sizes by the method already explained, will be found to be the quickest and most convenient process of procedure. The tubs should be the two halvesof a hogshead, one being used to rough pan the ground in, whilst the other one should always be set aside with clean water

to finish the panning, so as to thoroughly clean the wash, thereby minimising the chance of overlooking any diamonds. By this method it will be found that three or four tubs of water can be made to go a long way in case water is scarce or far distant. After manipulating the number of loads of ground mentioned, though perhaps no diamonds have been found, the prospector will be able to form some idea, by an inspection of the heavy deposit exposed on the overturned sieve full of ground, what prospect he has of finding diamonds. Operations should not be confined to one locality, it is always an advantage to test the pipe in several places, for the sufficient reason that diamond mines are not of an even richness, some spots being much richer than others, whilst some are nearly barren. If diamonds are found those recovered from the surface soil should be kept separate from those actually taken from the yellow or blue ground. It should be noted that the first-mentioned souce is misleading, and in estimating the yield per 100 loads, the diamond matrix, or yellow ground, can alone supply the necessary data, as the surface soil probably contains many diamonds which have gravitated down, as the pipe has been slowly worn away under subærial influences. If the results are encouraging, then a small rotary pan should be erected on a convenient spot near the mine, and systematic treatment of the ground gone in for. It will not be necessary to give a description of the machinery required, or how it is worked, for once having found a diamond mine, it is an easy task to obtain the services of a good practical man—and many of these are to be found—to direct and control the future operations.

I trust the foregoing few hints to the seeker after wealth, together with the description of how to manipulate the sieves, will prove sufficiently clear and comprehensive to be of value to him I fully realise the difficulty of so exactly explaining the details of the *modus operandi* that it can be readily grasped by the unpractised person ; but I am convinced that any one, no matter how new to the process, will successfully handle the sieves if he will follow the instructions I have given. Our friend the "new chum" need not be discouraged at failing to overturn the sieve without disturbing the gravitated contents, as success can only come with practice. If the prospector is only shown how gravitating the gravel and overturning the sieve is accomplished, he will be able to do it himself within a few hours, and within a week will he be an adept at it.

All stones which resemble a diamond in any way should be put to one side for careful scrutiny later on, when some of the tests already given can be applied. It would be as well for the prospector who is unacquainted with the diamond to provide himself with a glazier's diamond. If the stone, suspected to be a diamond, is easily scratched then it is

not the precious gem ; if scratched on great pressure being exerted it is probably one of the conundum family (sapphire) ; if marked without much difficulty, a topaz ; but if scratched with extreme difficulty or uot at all, it is a diamond. It would also be advisable for the prospector to carry a few bits of garnets, carbon, olivine, etc., with him for the sake of comparison, and also to show to farmers and natives for the purpose of ascertaining if they know any locality where these minerals occur. It may happen that such a locality is known to the farmer or one of his cattle herdsmen, and the prospector for a small remuneration may be led direct to the mine. A fragment of the yellow ground (oxidized mineral) and a piece of the "blue" will be found invaluable for the purpose of comparing with rocks in the field, and those not well up in the diamond matrix should provide themselves with these and make themselves acquainted with their outward appearance.

The writer hopes that he has made himself sufficiently clear on points of vital importance to the prospector, and trusts he has supplied the necessary data for practical use. An avoidance of technical terms has been observed, and the subject dealt with in this chapter presented to the ordinary prospector in language which he will easily comprehend.

Chapter VII.
WHERE TO SEARCH FOR DIAMONDS.

Before the announcement that the Monastery Mine was situated in the Cave Sandstone or uppermost sedimentary bed of the Karoo Series, was made by Mr. Draper about a year ago, the fact that diamonds were not confined to the Lower Karoo or Kimberley Shales was not recognised.

The position of the Monastery Mine in the geological sequence of the South African rocks, has practically increased the area wherein diamond bearing volcanic pipes may be found, to an extent, limited only by the shores of this continent.

There is now no doubt but that the period wherein some of the diamond pipes reached the surface, was not earlier than the Cave Sandstone (jurassic), and that those which now appear on the surface, surrounded by rocks of the Molteno, Beaufort, Ecca, or Magaliesberg periods, have either been lowered to their present geological position by denudation or they came to the surface *since the country had received a great portion of its present surface outlines.*

It will be reasonable to assume that the epoch of diamond pipes was confined to one period of time, and that all the mines are of one age chronologically. If this is not the case, then the alternative of a number of successive eruptions, similar in operation and containing identical mineralogical features, but with great intervening lapses of time, must be accounted for.

Then again, there appears to be a certain regularity of occurrence, along distinct lines which these eruptions favoured, and in the course of which diamonds are found to-day. One of these runs apparently in a north-easterly direction intersecting the Jagersfontein, Robinson, Driekoppes, and Rietfontein (Pretoria) Mines, and it is interesting to note that if this line is extended south-westward into the Cape Colony, it intersects the pipe which was worked years ago on the farm Klein Andriesfontein, near Hanover, and that the diamond finds near the Inlandsche Zee, and on the Keller property, in the Orange Free State, lie along what was probably this line of fissure or fault. If this line is extended north-eastward it passes slightly to the eastward of the Springbok Flats, where diamonds are reported to have been found, and terminates in the Klein Letaba, from whence diamonds have been obtained.

It is also interesting to note that the " pipe amygdaloid " of the Drakensberg, which possibly indicates another line of " fissure irruption " runs in the same direction as the line of diamond mines and parallel with it, and that the principal faults in the Witwatersrand, Magaliesberg, and Gatsrand have a somewhat similar direction of strike.

When one critically examines a diamond pipe it is difficult to believe that it represents a small hole, which has been punctured in the earth's crust by some force acting from within. It is more natural to assume that a fault, or fracture occurred, and that the diamond pipes are simply bulges or irregularities in the line of fault, and that these served as passages through which the molten or plastic mineral, carrying the diamonds, found its way to the surface.

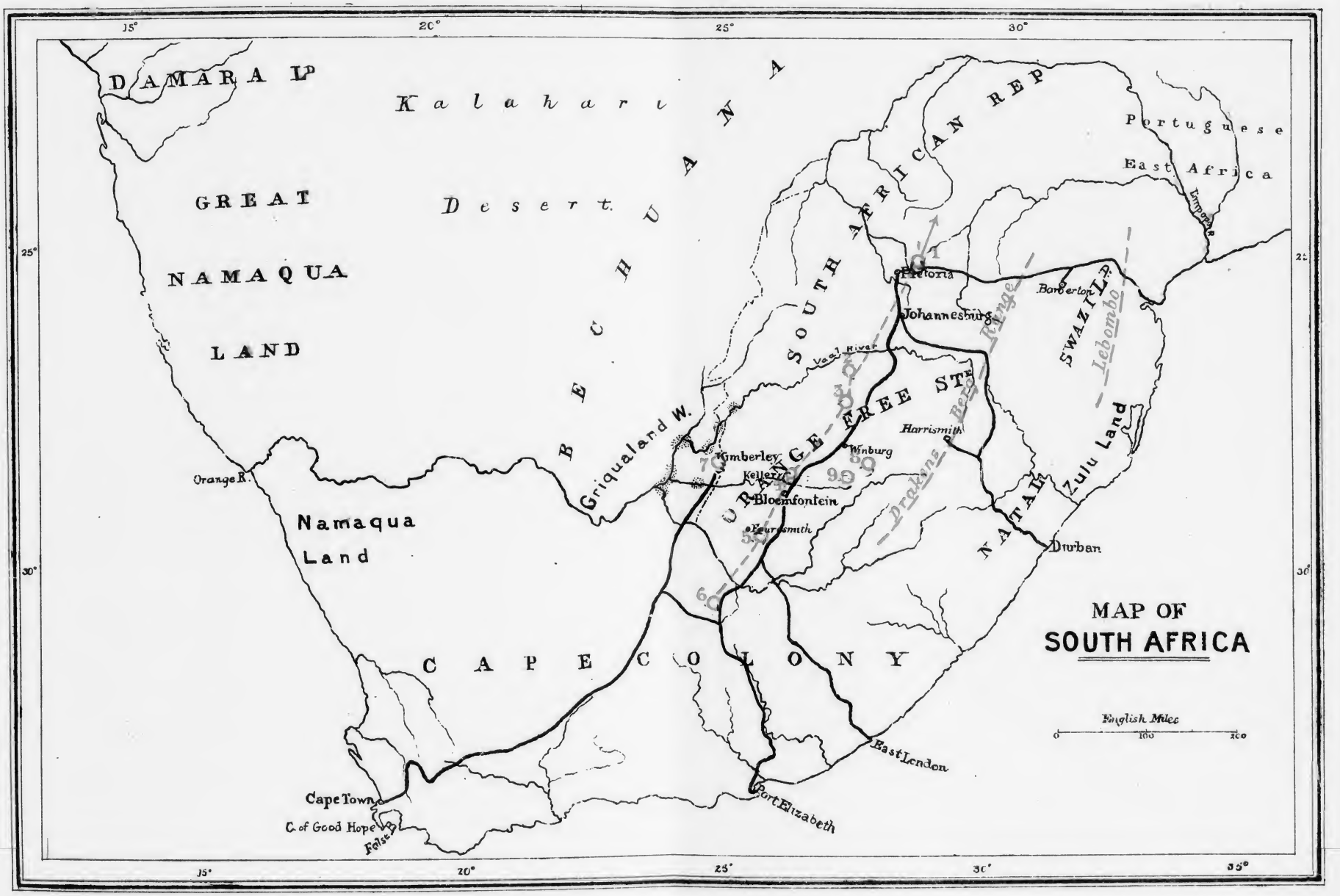
Dr. Molengraaff some years ago published this theory in a little work on South African Geology, entitled "Schets van de Bodemgesteldheid van de Zuid Afrikaansche Republiek, etc.," door G. A. F. Molengraaff, and published by E. J. Brill, Leiden, 1890.

On page 41 of the above-mentioned pamphlet there is a diagram, illustrating the direction of several of these lines of fracture, and though this is correct so far as the knowledge of diamond mines at the time the book was published is concerned, recent discoveries, coupled with the previously known facts, show that there is great probability that the principal line of fissure runs in the direction described in these pages, and that it is along this line that the most important discoveries of diamonds will be made. Prospectors are therefore advised to search in the direction of and along the line which is indicated in the map attached.

Naturally a fissure or fault would not adhere to a perfectly straight line, there would be a certain amount of irregularity in its course which must be taken into consideration; but the principal matter to be observed is *general direction*, and that can be best ascertained by examining a larger map of South Africa, and noticing the direction in which the line of diamond pipes, previously mentioned, takes and then either extending this at either end or searching in the country which lies between the already discovered mines.

We would, however, caution those who are new to the business that there are many blanks to a prize in diamond prospecting. Every volcanic pipe is not a payable diamond mine, and many are perfect "duffers." Nor are the garnets, carbons and greenstones infallible in their indication of a diamond mine. *Though the diamond has never been discovered except in their company, they have been found in abundance without the diamond.*

MAP OF SOUTH AFRICA, SHOWING POSITION OF THE PRINCIPAL DIAMOND MINES THUS ○
PLATE 4. ALLUVIAL DIAMOND BEARING GRAVELS SHOWN THUS ▒



DIAMOND PIPES: 1. Rietfontein (Pretoria). 2. Driekoppies. 3. Robinson. 4. Keller? 5. Jagersfontein. 6. Klein Andriesfontein 7. Kimberley Group. 8. Monastery. 9. Carmel.

NOTE.—The Arrow points in the direction of the Main Fracture described on page 35.

CONCLUSION.

A FEW HINTS TO PROSPECTORS.

In searching for a diamond mine don't look for *a circle of dolerite or igneous rock.* No mine that has yet been discovered had such an enclosing circle. Kimberley was utterly devoid of such an occurrence.

There was in fact nothing on the surface to denote the presence of the richest diamond mine that has yet been discovered. No kopje or hillock nor circular enclosure of igneous rock, nothing but a rise of a few feet in the plain, a few chunks of white limestone peeping through the red sand, and several kameel thorn tree scattered about the surface.

Limestone tufa is no indication of a diamond mine. This feature was certainly associated with the Kimberley and Wesselton Mines, but was absent from most of the others and utterly wanting at Rietfontein.

Search diligently in the stuff *brought to the surface by the burrowing animals.* These are good prospectors, and their work costs nothing. They give a general idea of what is under the surface for a distance of several feet.

If a *patch of different coloured soil* is noticeable, and if this is in a roughly circular shape, it will be well to examine it carefully.

Though not giving this as a hard and fast rule, most diamond mines have a red earthy covering due to the decomposition of the diamond bearing mineral itself probably. This was particularly in evidence on the Rietfontein Mine, where a small patch of bright red soil was surrounded by an encircling line of white or grey earth. The red patch indicated the extent of the mine to within a few feet.

Don't be afraid to search for a diamond mine anywhere in South Africa (at any rate so far north as the Limpopo). *There is no limit to the area in which it may be found, either in geological position or in the altitude above sea level.*

Notice whether a certain number of mines appear to follow a distinct direction, and if so proceed to examine the intervening country or extend the prospecting operations in either direction beyond the outside mines. A line of fissure may exist in that direction, and possibly certain swellings or pipes exist which may contain diamonds.

The majority of diamond mines discovered up to date, have been richer on the surface than in depth : Kimberley, Du Toit's Pan, and Bultfontein are notable examples of this feature, which, in all probability, is due to a process of weathering, to which the mineral in the pipes has been subjected.

The diamond, being practically indestructible, would survive for the most lengthy period, whereas the accessory minerals, and especially the matrix, would disintegrate, and crumble into powder, which would be removed from its original home, by the summer rains and winter winds.

The upper portions of the diamond pipes really contain the concentrates produced by surface weathering, hence their richness in the diamond, and its more durable companions.

APPENDIX.

THE FIRST LAW FOR THE REGULATION OF DIAMOND MINING IN SOUTH AFRICA.

STAFFORD PARKER, Esq.,
FIRST PRESIDENT OF THE KLIP RIVER DIAMOND FIELDS,
ELECTED JULY 30TH, 1870.

RULES AND REGULATIONS FOR THE VAAL RIVER DIAMOND FIELDS.

Alluvial Claims.

1st.—Every man to be allowed 20 feet square. No party claims to exceed six in number, whose sole claim must be taken in conjunction.

2nd.—The boundary of each claim to be distinctly marked, and such marks at all times to be kept free from rubbish.

3rd.—All claims to have free access at all times for the removal of wash dirt over any other claims that may be at work.

4th.—No claims to be allowed to throw their rubbish upon their neighbour's claim without permission.

5th.—Should any dispute arise between two or more parties respecting their claim, such dispute shall be settled by the arbitration of four assessors appointed by the parties in dispute, and a referee to be called in by the assessors, if necessary, whose decision shall be final.

6th.—Should any party or parties mark off more ground than allowed by these rules, any other person shall have the option of taking the surplus ground from any side of such claim he may think proper.

River Claims.

7th.—Each man to be allowed fifty feet frontage along the bed of the river, the same to be distinctly marked at low water mark.

Prospecting Claims.

8th.—Any person discovering a new run or patch of diamonds shall, upon reporting the same to a committee appointed be entitled to four ordinary claims, and such report to be posted up in a conspicuous place on the present diggings, stating the locality ; and should he fail in reporting, and another person finds payable ground in the same locality, the first person reporting shall be entitled to the prospecting claim.

9th.—No party shall be allowed to remain absent from his claim more than three successive working days, unless in case of sickness, work in conjunction with his claim as washing, etc., or pressing business, when a notice must be posted up on his claim stating the time of his absence, after which time the claim shall be considered as abandoned.

10th.—No man shall be allowed more than one claim at the same time.

11th.—Any person against whom it shall be proved as having picked up a diamond upon a claim belonging to another and not restoring it to the owner of such claim immediately, shall be considered as a thief and expelled the diggings.

12th.—No heap of dirt upon any abandoned claim shall be considered as private property, unless it can be shown to a committee that some accident, such as rain, breakage of wagon, etc., has prevented the washing or sieving of such heap of dirt.

13th.—That no party or parties shall be allowed more than five niggers to work their claim.

P. D. J. VANDERBYL, Chairman.

WEIGHTS USED FOR PRECIOUS STONES.

4 Diamond Grains 1 Carat
150 Carats 1 oz Troy.

A diamond grain is equal to 0.8 of a troy grain.

HARDNESS AND SPECIFIC GRAVITY OF THE PRINCIPAL PRECIOUS STONES.

	HARDNESS.	SP. GR.	COMMON COLOURS.
Carbonado or Black Diamond ...	10	3.0 to 3.4	Black.
Boart	10	3.5	Grey, lead colour.
Diamond ...	10	3.5	White, colourless yellow.
Sapphire ...	9	3.9 to 4.1	Blue.
Ruby	9	3.9 to 4.1	Red.
Topaz	8	3.4 to 3.6	Straw, white.
Zircon	7.5	4.0 to 4.7	Brownish yellow.
Garnet	6.5 to 7.5	3.15 to 4.3	Red.
Spinel	8	3.5	Red.

These will sink in the gravity Solution of sp. gr. of 3.17.

	HARDNESS.	SP. GR.	COMMON COLOURS.
Beryl	7.5	2.6 to 2.7	Greenish yellow.
Emerald ...	7.5	2.5 to 2.7	Green.
Tourmaline ...	7 to 7.5	2.9 to 3.3	Black, rose.
Amethyst ...	7	2.5 to 2.8	Purple.
Quartz... ...	7	2.5 to 2.8	White, transparent.
Agate	7	2.5 to 2 8	White.
Onyx	7	2.5 to 2.8	White on darker colour.
Torquoise ...	6	2.6	Light blue.
Moonstone ...	6	2.4	Pearly.
Opal	5. to 6.	1.9 to 2	Iridescent.

These will float on the gravity Solution as above.

Telegraphic Address : "BOILERS."

Moreing and Neave's, 1895, and A B C Codes used.

H. J. C. KEYMER,

Consulting Engineer,

Box 2729, JOHANNESBURG.

FOR **MACHINERY** of the latest and most complete character for treating Diamondiferous Soil, Rocks, etc., H. J. C. KEYMER represents the best Manufacturers, and, with the largest experience in such manufactures, will be pleased to advise upon the Machinery suitable, prepare Plans, and carry out the erection of the same, if required.

Also Agent for all up-to-date

Steam, Electrical, and Water-power Plants,

And will be pleased to Quote for any of the above on Application.

TAYLOR and CO., *CHEMISTS & DRUGGISTS,*

PRITCHARD ST., VON BRANDIS SQUARE,

Always keep on hand

LARGE STOCKS OF CHEMICALS

And Apparatus requisite for Assaying Ores, Minerals, etc.

Solution for taking the Specific Gravity A Speciality.

Cases of Chemicals and Test Apparatus Prepared to Order for Prospectors.

NEW & SECOND-HAND

MACHINERY.

Engines (Driving and Winding),
Boilers, Diamond Drills,
Pumps, Rails, Piping, Trucks, Tents,
Jumper Drills, Winches, Hose,
Bucket Elevators,
Engine and Boiler Fittings,
Windlasses, etc., etc.

PROSPECTORS'
. . OUTFIT . .

DIAMOND FARMS REPORTED UPON.

HAROLD S. HARGER,
4, GREEN'S BUILDINGS,
JOHANNESBURG.
P.O. Box 1945. **P.O Box 1945.**